

- (21) Application No. 57659/72 (22) Filed 14 Dec. 1972 (19)
 (23) Complete Specification filed 13 Dec. 1973
 (44) Complete Specification published 22 Sept. 1976
 (51) INT. CL.² B01D 27/10
 (52) Index at acceptance

B1D 106 109 164 166 182 183 190 191 194 196 201 203
 209 321 322 331 335 337 604 624 687 691 694
 712 713 715 751 755 758 761

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(54) FILTERS FOR LIQUIDS

(71) We, GENERAL MOTORS LIMITED, a British Company of High Street North, Dunstable, Bedfordshire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to filters for liquids and in particular to oil filters for internal combustion engines; the invention is especially applicable to so-called screw-on discardable oil filters in which a filter element is housed in a cup-shaped sheet metal casing having at least one inlet opening therein radially spaced from a central outlet opening in an end plate for the casing, the end plate having a threaded portion adapted to be engaged with a complementary threaded portion of a mounting for the filter, the whole filter unit being discarded and replaced by a new unit when the filter element has become blocked.

In such a liquid filter according to the present invention the liquid is caused to flow from the exterior to the interior of a hollow filter element having a central outlet passage and from thence to said central outlet opening by means of a first annular seal member interposed coaxially between the end plate and an annular surface on the adjacent end of the element around one end of the central passage then through the central opening, there being at the other end of said central passage a second annular seal member with an outwardly extending radial flange thereon, one end portion of said second seal member being pressed by a spring into sealing engagement with an annular surface on the adjacent end of the element around the other end of said central passage, and said radial flange resiliently engaging the end wall of the casing to form a seal therewith, the respective areas of said annular seal members exposed, in use, to fluid pressure being such that in the event of the pressure drop across

the filter element exceeding a predetermined value the differential pressure on said areas effects axial movement of the element and seal members so as to unseat the first seal member from the end plate and permit a by-pass flow of liquid direct from said inlet opening(s) to said outlet opening, the radial flange on said second seal member flexing to permit such axial movement without breaking the seal with said end wall of the casing.

Preferably, the first seal member also has an outwardly extending flange which resiliently engages an annular portion of said end plate radially outwards of the inlet opening or openings therein so as to form a seal therewith when the filter is not in use, and act as a non-return valve which opens under the pressure of liquid delivered to said inlet opening(s) during use of the filter but which forms a seal with said end plate when the inlet pressure drops, so as to minimise leakage from the inlet opening(s) of the liquid within the filter.

Preferably, each seal member is formed as a ring of synthetic rubber or like material of a thickness sufficient to space the respective ends of the element from the end plate of the element and the inner periphery of the element at one end with an annular shoulder so that a portion of the ring fits within an end of the central passage through the element with the shoulder overlying the end of the element and the inner periphery of the element at said end to form a seal therewith, and the ring having integral therewith said outwardly extending radial flange which is preferably formed at its outer periphery with an annular bead to engage and form a seal with the end plate or wall. The inner periphery of the first seal member may be formed with recesses which facilitate flow of liquid between the inlet and outlet openings of the filter when the said first seal member is completely unseated from the end plate.

The second seal member is generally semi-

lar in construction to the first said seal member but, at the end thereof opposite that which fits within the adjacent end of the central outlet passage through the filter element, is formed with a substantially flat annular end face so as to form a seat for a flanged rim of a cup-shaped retainer for a spring one end of which engages the end wall of the casing and the other end of which engages the base of the retainer, the base being formed with a central perforation therein. The pressure of the spring acting on the second annular seal member presses the latter into sealing contact with the adjacent end of the filter element and also urges the filter element and the first seal member into sealing engagement with each other and with the end plate. The annular flange on the second seal member resiliently engages the end wall of the casing and remains in sealing contact therewith within a predetermined range of axial movement of the assembled filter element and seal members.

The inner periphery of the first seal member may be formed with an annular recess in which can be located a radial flange provided at one end of an anti-drain tube, in cases in which it is desirable to fit an anti-drain tube within the filter element.

The scope of the invention is defined by the appended claims; and the invention and the method by which it is to be performed are hereinafter particularly described with reference to the accompanying drawing with which the single figure is a vertical section through a filter according to the invention.

The drawing shows an oil filter comprising a filter shell or casing 1 within which is an annular pleated paper filter element 2. The casing 1 is of cup-shape and made of thin sheet metal and at its open end there is secured a circular end plate 3 of thicker gauge metal having a central opening 4 in an integral neck 5 which is internally threaded and extends within the casing 1, the internally threaded neck 5 being adapted to be engaged with a complementary threaded hollow spigot on an internal combustion engine mount face which has an opening by which oil from the engine lubrication system is delivered to a plurality of openings 10 which are positioned around the central opening 4 in the end plate 3 and form the inlet to the filter, the opening 4 constituting the outlet from the filter by which the oil delivered to the filter and filtered by passage through the element 2 is returned to the engine lubrication system.

The end plate 3 is secured to the open end of the casing 1 by means of an annular disc 11 of thin sheet metal which is spot welded or otherwise secured coaxially with the end plate 3. The outer peripheral portion of the thin sheet metal disc 11 initially

extends radially beyond the outer periphery of the end plate 3 and is secured to the end of the casing 1 by means of a rolled seam joint 12.

The inner portion of the annular disc of sheet metal 11 is turned over to form, adjacent the rolled seam joint 12, an annular trough in which is secured, as by adhesive, an annular gasket 14 of rubber or like resilient material.

The annular filter element 2 is made of a strip of synthetic resin-impregnated filter paper or like material folded to form a series of pleats 15 in which the fold lines extend longitudinally of the annulus; the opposite ends of each pleat are preferably sealed separately from the ends of adjacent pleats, as by adhesive 16 between the end portions of the two parts of each pleat. Thus, as shown in the drawing, the filter element does not need to be provided with annular end caps sealed to each end of the element, such as are commonly employed in pleated filter elements.

The filter element 2 is mounted on a central perforate support tube 17 and the upper end of the element 2 is sealed to the end plate 3 by means of an annular seal member 23 which also constitutes a non-return valve. The annular seal member 23 is made of synthetic rubber or like material and has faces 24, 25 which respectively engage the end plate 3 about the neck 5 thereof and the upper end of the element 2 about the central passage within the support tube 17, the seal member 23 also having an integral outwardly extending annular flange 26 arranged so as normally to overlie and close the inlet openings or passages 10 in the end plate 3. The seal member 23 has an inner radial flange 27 with radial recesses 13 therein by which it is located coaxially on the neck 5 of the end plate 3.

At its lower end the element 2 is sealed to the base of the casing 1 by a further annular seal member 30 made of synthetic rubber or like elastomeric material and formed with an external shoulder which fits within the lower end of the element and has an annular end face 31 which engages and forms a seal with the adjacent end of the element around the central opening at said end. The seal member 30 also has an integral outwardly extending annular flange 32 which engages and forms a seal with the surface of the base of the casing 1.

The annular seal member 30 has a substantially flat face 33 opposite the shoulder face 31, the face 33 forming a seat for a flanged rim 34 of a cup-shaped retainer 35 for a helical spring 36, one end of which engages the end wall of the casing 1 and the other end of which engages the base of the cup-shaped retainer 35, which is formed with a central aperture 37 therein to avoid

pressure build-up within the cup or downward movement thereof.

The pressure of the spring 36, acting on the seal member 30, presses the latter into sealing contact with the lower end of the element 2 and also presses the element 2 and the first seal member 23 into sealing engagement with each other and with the end plate 3. The annular flange 32 on the seal member 30 resiliently engages the base of the casing 1 and remains in contact therewith within a predetermined range of axial movement of the assembled filter element 2 and seal member 30.

The inner periphery of the seal member 23 may be formed, as shown, with an annular recess in which can be located a radial flange 38 at one end of an anti-drain tube 39, in cases in which it is desirable to fit an anti-drain tube within the element 2.

OPERATION

The inlet openings 10 in the end plate 3 of the filter are normally sealed off from the interior of the filter casing 1 by the engagement of the annular flange 26 of the first seal member 23 with the end plate 3 but, under the pressure of liquid delivered to the inlet openings 10 the flange 26 is deflected to allow the liquid to enter the filter, the liquid being filtered by passage through the filter element 2 from the exterior to the interior thereof and then leaving the filter by way of the central outlet opening 4 therein. In the event of the pressure drop across the filter element 2 exceeding a predetermined value, as for example when the liquid delivered to the filter is of excessive viscosity, as a result of low temperature, or when the filter element 2 has become blocked with deposited solids, the differential pressure exerted on the assembled filter element 2 and seal members 23, 30 overcomes the pressure of the spring 36 and causes movement of the assembled seal members 23, 30 and filter element 2 axially of the filter so as to unseat the first said seal member 23 from the end plate 3 and thereby permit a by-pass flow of liquid direct from the inlet openings 10 to the outlet opening 4 in the end plate 3. During such movement the seal between the radial flange 32 on the other seal member 30 at the base of the filter housing 1 remains unbroken as the flange 32 flexes but remains in sealing engagement with the base of the housing 1.

The seal member 23, and to some extent the seal member 30, is similar in construction to that disclosed in our prior British Patent 978,517.

WHAT WE CLAIM IS:—

1. A liquid filter in which a hollow filter element having a central outlet passage therethrough is housed in a cup-shaped sheet

metal casing closed by an end plate which, around an outlet opening therein, is formed with a central threaded portion adapted to be engaged with a complementary threaded portion of a mounting for the filter, there being at least one inlet opening radially spaced from said outlet opening in the end plate, and in which a first annular seal member is interposed co-axially between said end plate and an annular surface on the adjacent end of the element around one end of said outlet passage, so as under normal filtering conditions to compel liquid which enters the casing from said inlet opening or openings in the said end plate to pass through the element from the outside to the inside thereof and to be discharged from the casing through said central outlet opening in the end plate, and in which a second annular seal member with an outwardly extending flange thereon is positioned at the other end of said central passage, one portion of said second seal member being pressed by a spring into sealing engagement with an annular surface on the adjacent end of the element around the other end of said outlet passage, and said flange resiliently engaging the end wall of the cup-shaped casing to form a seal therewith, the respective areas of said annular seal members which, in use, are exposed to fluid pressure being such that in the event of the pressure drop across the filter element exceeding a predetermined value the differential pressure on said areas effects axial movement of the element and seal members so as to unseat the first seal member from the end plate and permit a by-pass flow of liquid direct from said inlet opening or openings to the outlet opening, the flange on said second seal member flexing to permit such axial movement without breaking the seal with said end wall of the casing.

2. A liquid filter according to claim 1, in which the first seal member also has an outwardly extending radial flange which resiliently engages an annular portion of said end plate radially outwards of said inlet opening(s) therein so as to form a seal therewith when the filter is not in use, and act as a non-return valve which in use opens under the pressure of liquid delivered to said inlet opening(s).

3. A liquid filter according to claim 1 or 2, in which said second seal member is formed as a ring of synthetic rubber or like material of a thickness sufficient to space the adjacent end of the element from the casing end wall, and is formed at one end with an annular shoulder so that a portion of the ring fits within said other end of the central outlet passage through the element with the shoulder overlying the adjacent end of the element and the inner periphery of the element at said adjacent end to form a seal

therewith, the ring having integral therewith at its other end said outwardly extending radial flange.

4. A liquid filter according to claims 1 to 3, in which said first seal member is formed at its inner periphery with recesses which facilitate flow of liquid between the inlet and outlet openings of the filter when the said first seal member is completely unseated from the end plate.

5. A liquid filter unit according to claim 3, in which said second seal member has at the end thereof opposite that which fits within the adjacent end of the central outlet passage through the filter element, a substantially flat annular end face so as to form a seat for a flanged rim of a cup-shaped retainer for the spring one end of which engages the end wall of the casing and the other end of which engages the base of the retainer, said base being formed with a central perforation therein, the pressure of

the spring pressing the second seal member into sealing contact with the adjacent end of the filter element and also urging the filter element and the first seal member into sealing engagement with each other and with the end plate, and the annular flange on the second seal member resiliently engaging the end wall of the casing and remaining in sealing contact therewith within a predetermined range of axial movement of the assembled filter element and seal members.

6. A liquid filter unit according to claims 1 to 5, in which the inner periphery of the first seal member is formed with an annular recess in which is located a radial flange provided at one end of an anti-drain tube.

7. A liquid filter unit substantially as hereinbefore particularly described and as shown in the accompanying drawing.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1976.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

